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Reg. No. :

Question Paper Code : 31526

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Sixth Semester

Computer Science and Engineering

MA 2264/MA 41/MA 51/080280026/10177 MA 401/10144 CSE 21/10144 ECE 15 — NUMERICAL METHODS

(Common to Sixth Semester – Electronics and Communication Engineering and Information Technology Fifth Semester – Polymer Technology, Chemical Engineering and Polymer Technology Fourth Semester – Aeronautical Engineering, Civil Engineering, Electrical and Electronics Engineering and Mechatronics Engineering)

(Also common to Fourth Semester MA 1251 – Numerical Methods for Civil Engineering, Aeronautical Engineering and Electrical and Electronics Engineering)

(Regulation 2008/2010)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you mean by the order of convergence of an iterative method for finding the root of the equation $f(x)=0$?

2. Solve the equations $x+2y=1$ and $3x-2y=7$ by Gauss-Elimination method.

3. State Newton's forward difference formula for equal intervals.

4. Find the divided differences of $f(x)=x^3-x^2+3x+8$ for the arguments 0, 1, 4, 5.

5. Evaluate $\int_{-2}^{2} e^{\frac{-x}{2}}\,dx$ by Gauss two point formula.

6. Evaluate $\int_{0}^{6} \frac{dx}{1+x^2}$ using Trapezoidal rule.

7. State Adam's Predictor-Corrector formula.

8. Using Euler's method find the solution of the initial value problem $y' = y - x^2 + 1$, $y(0) = 0.5$ at $x = 0.2$ taking $h = 0.2$.

9. Write the diagonal five point formula for solving the two dimensional Laplace equation $\nabla^2 u = 0$.

10. Using finite difference solve $y'' - y = 0$ given $y(0) = 0$, $y(1) = 1$, $n = 2$.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Solve the equations by Gauss-Seidel method of iteration.

$10x + 2y + z = 9$, $x + 10y - z = -22$, $-2x + 3y + 10z = 22$. (8)

(ii) Determine the largest eigen value and the corresponding eigen vector of the matrix $\begin{pmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{pmatrix}$ with $(1 \ 0 \ 0)^T$ as the initial vector by power method. (8)

Or

(b) (i) Find the inverse of the matrix $\begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$ using Gauss-Jordan method. (8)

(ii) Using Newton's method, find the real root of $x \log_{10} x = 1.2$ correct to five decimal places. (8)

12. (a) Find the natural cubic spline to fit the data :

x :	0	1	2
$f(x)$:	-1	3	29

Hence find $f(0.5)$ and $f(1.5)$. (16)

Or

(b) (i) The following table gives the values of density of saturated water for various temperatures of saturated steam. (8)

Temperature °C :	100	150	200	250	300
Density hg/m³ :	958	917	865	799	712

Find by interpolation, the density when the temperature is 275°.

(ii) Use Lagrange's formula to find the value of y at $x = 6$ from the following data : (8)

x :	3	7	9	10
y :	168	120	72	63

13. (a) (i) Apply three point Gaussian quadrature formula to evaluate $\int_0^1 \frac{\sin x}{x}\, dx$. (8)

(ii) Find the first and second order derivatives of $f(x)$ at $x=1.5$ for the following data : (8)

x :	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$:	3.375	7.000	13.625	24.000	38.875	59.000

Or

(b) (i) The velocities of a car running on a straight road at intervals of 2 minutes are given below :

Time (min) :	0	2	4	6	8	10	12
Velocity (km/hr) :	0	22	30	27	18	7	0

Using Simpson's $\frac{1}{3}$-rd rule find the distance covered by the car. (8)

(ii) Evaluate $\int_2^{2.4}\int_4^{4.4} xy\, dx\, dy$ by Trapezoidal rule taking $h=k=0.1$. (8)

14. (a) (i) Obtain y by Taylor series method, given that $y'=xy+1$, $y(0)=1$, for $x=0.1$ and 0.2 correct to four decimal places. (8)

(ii) Use Milne's method to find $y(0.8)$, given $y'=\frac{1}{x+y}$, $y(0)=2$ $y(0.2)=2.0933$, $y(0.4)=2.1755$, $y(0.6)=2.2493$. (8)

Or

(b) Using Runge-Kutta method of order four, find y when $x=1.2$ in steps of 0.1 given that $y'=x^2+y^2$ and $y(1)=1.5$. (16)

15. (a) By iteration method solve the elliptic equation $u_{xx}+u_{yy}=0$ over the square region of side 4, satisfying the boundary conditions.

(i) $u(0, y)=0, 0\le y\le 4$

(ii) $u(4, y)=8+2y$, $0\le y\le 4$

(iii) $u(x, 0)=\frac{x^2}{2}$, $0\le x\le 4$

(iv) $u(x, 4)=x^2$, $0\le x\le 4$

Compute the values at the interior points correct to one decimal with $h=k=1$. (16)

Or

(b) (i) Using Crank-Nicolson's scheme, solve $16\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$, $0<x<1$, $t>0$ subject to $u(x, 0)=0$, $u(0,t)=0$, $u(1, t)=100t$. Compute u for one step in t direction taking $h=\frac{1}{4}$. (8)

(ii) Solve $u_{tt}=u_{xx}$, $0<x<2$, $t>0$ subject to $u(x, 0)=0$, $u_t(x,0)=100(2x-x^2)$, $u(0, t)=0$, $u(2, t)=0$, choosing $h=\frac{1}{2}$ compute u for four time steps. (8)